(19) Europäisches Patentamt
European Patent Office
Office européen des brevets

(11) Publication number: **0 575 823 A1**

(12) EUROPEAN PATENT APPLICATION

(21) Application number: **93109274.6**

(22) Date of filing: **09.06.93**

(51) Int. Cl.5: **B24B 21/02**, B24B 21/08, B24B 21/14

(30) Priority: **23.06.92 IT VI920102**

(43) Date of publication of application:
29.12.93 Bulletin 93/52

(84) Designated Contracting States:
AT BE CH DE DK ES FR GB LI NL SE

(71) Applicant: **IDROMECCANICA DI ROSA VALERIO**
Via Giotto 2
I-36030 Lugo (VI)(IT)

(72) Inventor: **Rosa, Valerio**
Via Giotto 2
I-36030 Lugo (VI)(IT)

(74) Representative: **D'Agostini, Giovanni, Dr.**
D'AGOSTINI ORGANIZZAZIONE
n. 17 via G.Giusti
I-33100 Udine (IT)

(54) Smoothing-polishing machine for cylindrical surfaces.

(57) According to the invention a smoothing-polishing machine is realized for cylindrical surfaces comprising a base (2) on which ios at least one rising column (3), to which is connected a smoothing group (6) composed from an abrasive belt (50) wound between a pair of drums (21) and a pressure group (5) pressing the abrasive belt (50) against the cylindrical surface (20) to be treated.

The said pressure group (5) is made from a case (14) that supports a plurality of idle cylindrical rollers (7), aligned amongst themselves and connected to a kinematic movement (62) of advancement able to move them in a direction parallel to the axis of the cylindrical surface (20) to be treated along its generator (57), where the said cylindrical rollers (7), in the working phase, press on the backlining (60) of the abrasive belt (50), this last made horizontally movable according to the generator (57) of contact with the cylindrical surface (20) being treated, by the rotation of the drums (21) in which it is wound.

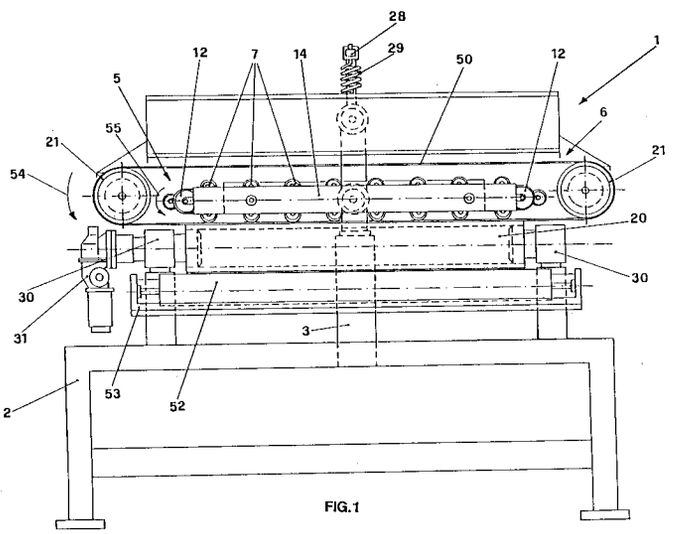

FIG.1

EP 0 575 823 A1

The invention concerns a smoothing-polishing machine for cylindrical surfaces.

It is known that the smoothing and polishing processes for cylindrical surfaces are carried out using universal grinders in which the work areas are treated by means of the use of abrasive grinding-wheels of variable grain depending on the degree of finish that is intended.

The described grinders have the drawbacks of a somewhat high cost and working times that are somewhat long and furthermore they do not give qualitatively acceptable results when used on cylindrical surfaces of soft material.

As regards in particular gravure rollers, which as is known to the experts of this sector are formed from a steel cylinder coated with a copper stratum deposited galvanically to a thickness of some hundredths of a millimetre, they are of particularly complicated workmanship.

It is in fact known that these cylinders when treated to eliminate the deteriorated or unwanted incisions, in order to eliminate the chrome and the incision made on the copper stratum, are galvanically stripped and the incision is therefore removed by special machines that complete the work in a short time but have an extremely high cost.

Sometimes other types of lathing-smoothing machines are used, which at first turn the cylinder and then smooth it by passing more than once over its surface with orbital grinding-wheels.

These machines are less expensive than the previous machines but have the big drawback of requiring very long execution times.

Both the known machines mentioned have the drawback that if the copper layer is over-stressed it would be in danger of being damaged.

It is in order to overcome such drawbacks that the invention realizes a smoothing-polishing machine whose object is to obtain a degree of roughness on cylindrical surfaces comparable to that obtained with polishers presently in use.

Another object of said smoothing-polishing machine is that it be of much simpler construction with respect to known polishers and also therefore less expensive to produce.

Another object is that the smoothing-polishing machine of the present invention allows briefer treating times with respect to those necessary with the known machines.

The last but not least object is that the smoothing-polishing machine of the invention, because of its particular way of working, totally eliminates, from the surfaces being treated, the possible signs of previous turning or grinding.

The objects described are reached by the realization of a smoothing-polishing machine for cylindrical surfaces which in agreement with the main claim includes a base on which is a support and rotation group for the cylindrical surface to be treated and at least one rising column to which are connected:

- a smoothing group composed of an abrasive belt wound between a pair of drums;
- a pressure group for pressing the abrasive belt against the cylindrical surface to be treated,

and is characterized by the fact that the said pressure group is made from a case that supports a plurality of idle cylindrical rollers, aligned amongst themselves and connected to a kinematic advancement movement that is able to move them parallel to the axis of the cylindrical surface to be treated along one of its generators, where said cylindrical rolls, in the treatment phase, press on the backlining of the abrasive belt, this last allowing horizontal movement according to the contact generator with the cylindrical surface being treated by the rotation of drums between which it is wound.

According to a preferred form of realization the rising column is connected to the base through at least one actuator that makes the column vertically movable with respect to the base.

The pressure group is connected via the interposition of a support bracket to the movable element of a first actuator whose body is fixed to the rising column and to the said support bracket and in its turn is fixed to the body of a second actuator whose mobile element supports the smoothing group.

Furthermore, during treatment the smoothing group moves in an alternating way, in a parallel horizontal direction with respect to the axis of the cylindrical surface being treated.

The described execution allows to realize the reciprocal independence of movements of the pressure group and of the smoothing group.

Another advantage is that the cylindrical rollers that equip the pressure group are composed from cylindrical brushes wrapped by a protective felt sheath that during treatment, exert on the backlining of the abrasive belt that equips the group of smoothers, a uniformly distributed pressure that pushes the abrasive surface of the belt against the surface of the cylinder to be treated.

Furthermore advantageous is that each of the said brushes has a limited width which is much inferior compared to the width of the abrasive belt, in such a way as to allow the concentration of the force with which it presses the abrasive belt against the area to be treated, along the generator of the same cylindrical surface.

Just as advantageous, furthermore, is the alternating displacement of the abrasive belt in an horizontal direction parallel to the generator of the cylindrical surface to be treated, allowing a uniform consumption of the surface of the abrasive belt.

The objects and advantages described will become better evidenced during the description of a preferred form of execution of the invention, which is given as an example but is not restrictive , and represented in the attached figures where:

- Figure. 1 represents the frontal view of the smoother-polisher, object of the invention;
- Figure. 2 represents an axonometric view of the particulars of the pressure group, with the relative rollers that push the abrasive belt pertaining to the smoothing group against the cylindrical surface being treated;
- Figure. 3 represents an axonometric view of the particulars of the pressure group with a view of the kinematic movements of advancement of the cylindrical rolls:
- Figure. 4 represents an axonometric view of the hanging system of the pressure group, with pneumatic control cylinders;
- Figure. 5 represents an axonometric view one of the said hanging groups represented in .Fig 1:
- Figure. 6 represents a schematic cross-section of the smoother of Fig. 1 with the smoothing and pressure groups released from the cylinder being treated;
- Figure. 7 represents the smoother from fig. 6 with the smoothing and pressure groups acting on the cylinder to be treated.:
- Figure. 8 represents a position of the smoothing group and of the pressure group in respect to the cylinder being treated:
- Figure. 9 represents another position of the smoothing group and of the pressure group in the working phase.

As can be seen in Fig. 1 and in Fig. 6 the smoothing-polishing machine of the invention, shown fully in1, includes a base 2 fixed to the ground from which rises a column 3 that is vertically mobile in respect to the base 2 through an actuator 61 composed from a ratiomotor 4 supported by the base 2 and supplied with a worm screw 67 that pairs to the column 3.

To column 3 are attached a pressure group fully indicated by 5 and a smoothing group fully indicated by 6.

At the base 2 of the smoother-polisher a pair of mandrels 30 are also fixed opposite to each other and between which is mounted the cylinder 20 to be treated that is placed in rotation by a ratiomotor 31 connected to one of the said mandrels.

As far as the pressure group fully shown with 5 is concerned, we point out in Fig.3 that it is made from a plurality of cylindrical rollers 7 that are idle in respect to its pivot 8 which it is fixed at their ends, through connection elements 9, to a kinematic advancement movement fully shown by 62 composed from a pair of chains 10 that are advanced in one of the two arrowed directions 11 by a pair of cog-wheels 12 placed in rotation through a pivot 13 connected to a motorization group not represented in the Figure.

The cylindrical rollers 7 and the relative kinematic advancement movement 62, are supported by a case 14 also visible in Fig. 2 which in turn is applied to a crossbar 15 visible in Fig. 4 and also in Fig. 6, this last being fixed to a bracket 16 which, as can be seen particularly in Fig. 6, is connected to the stem 17 of a first actuator 18, composed preferably of a pneumatic cylinder, by means of which the displacement of all the pressure group 5 is carried out.

In particular the ends of the pivots 8, during their displacement, slide in a runner 70 defined below the edge 71 of the case 14 and above a tubular protrusion 72 on which is applied a strip 73 in an elastic material, preferably rubber, that reacts resiliently against the ends maintaining pushed against the cylinder 20 in action the rollers 8 and therefore the cylinders 7 coupled to each of these.

We observe in particular in Fig. 6 that the first said actuator18 is fixed to the column 3 in connection with the upper surface 19 of this last which is tilted in respect to the horizontal so as to consent to the pressure group 5 an incidental displacement in the direction of the surface of the cylinder 20 to be treated. As far as the smoothing group is concerned, fully shown by 6, we observe in Fig.1 and in Fig.6 that it is made from a pair of drums 21 each connected to a motor 22 connected through a bracket 77 to a support beam 23 which is fixed to the stem 24 of a second actuator 25, which is fixed through a support 26 to the bracket 16 that supports the pressure group 5.

Finally we observe in Fig. 6 that for supporting all the weight of the projecting parts column 3 is supported from below also by a third actuator 27 that essentially has the function of supporter whilst the support beam 23 is supported by a truss 28 through an elastic element composed from a spring 29. Again as far as the pressure group 5 is concerned we observe in Figs.3, 4 and 5 that its case 14 is fixed to the crossbar 15 through a pair of suspension groups fully shown by 32, each of which, as can be seen in Fig.5, is made from a bracket 33, supported through a pivot 34 to the crossbar 15, supporting a projecting shaft 35 that pairs into a corresponding hole 36 visible in Fig.3 and passing through into the case 14.

Each shaft 35 is furthermore fixed to the stem 36 of a pneumatic cylinder 37 supported at the end 38, opposite to the stem, to the crossbar 15 which, when operated with compressed air, causes the rotation of the bracket 33 and therefore of the shaft 35 in the two directions shown by the arrows 39.

The bracket 33 furthermore has a reaction actuator

connected to its upper part 65 able with its force to support the weight of the pressure group that is burdened on the shafts 35.

The rotations conveyed to the brackets 33 by the actuators 37 consent the raising or lowering of the pressure group 5 always in parallel to the surface of the cylinder 20 being treated.

For carrying out the smoothing or the polishing of the cylindrical surface 20, an abrasive belt 50 is used which is taut between a pair of drums 21, one of which is provided with a pneumatic tensor (not represented in the Figure) that also allows the abrasive belt 50 to be maintained in tension during the treatment, this also allows its easy disassembly for its replacement.

Between the mandrels 30 the cylinder 20 to be treated is fixed and through a pair of raising beams 51 visible in Fig.6 and in Fig.7 placed at its ends, on the underside of the cylinder 20 a felt roller 52 is brought in adherence which is dipped in the cooling liquid contained in the tank 53 and allows a uniform and continuous wetting of the surface of the cylinder 20 during working.

The motors 22 are supplied so that the drums 21 are put into rotation, for example in the direction shown by the arrows 54. and analogously through a further motor, not represented in the Figure, the shaft 13 is placed in rotation by the kinematic advancement movement 62 of cylindrical rollers 7 of the pressure group 5 whose rollers 7 therefore begin to rotate in the direction indicated for example by the arrows 55.

In such a situation the smoother is found disposed as represented in Fig.6 where we observe that the cylinder 20 to be treated turns in the direction 56 moved by the ratiomotor 31 while the pressure group 5 and the smoothing group 6 rotate but are not yet placed in contact with the surface of the cylinder 20.

Operating the first actuator 18 and the second actuator 25, the abrasive belt 50 as we observe in Fig.7 is placed in contact with the surface of the cylinder 20 to be smoothed in connection with its generator 57 and analogously in connection with the same generator are pressed against the backlining 60 of the abrasive belt 50 cylindrical rollers 7 of the pressure group 5.

At the position now reached the first actuator 18 is no longer operated so that the pressure group 5 and the relative cylindrical rollers 7 always remain in the same position, while the second actuator 25 is continually supplied with compressed air in both directions so that its stem 24 is continually displaced horizontally right and left as indicated by the arrows 58, so that this movement. as we observe in Fig. 2, and in Fig. 9, causes the whole width of the abrasive belt 50 to be in contact with the surface of the cylinder 20 to be treated.

Such movement in two directions 58 is extremely important in as much as it provides for better working results on the surface of the cylinder 20 and also an even wear and tear of the belt on all its width.

As regards in particular the cylindrical rollers 7 they are composed from cylindrical brushes covered by a felt sheath and press, as we observe in Fig. 2, against the backlining 60 of the abrasive belt 50 which advances in the direction 54.

Said brushes being idle, they, for friction, are put into rotation according to the direction 61 and simultaneously being connected to the chains 10, they are also put in movement according to direction 55 that is conveyed to their pivots 8 by rotation of the shaft 13.

Furthermore all the said cylindrical brushes 7 are pressed against the backlining 60 of the abrasive belt 50 according to vertical direction 62 in that, as we observe in Fig. 6, the first actuator 18 is fixed to the tilted upper surface 19 of the rising column 3 so that the adherence pressure of the rotary brushes 7 against the backlining 60 of the abrasive belt 50 is adjustable according to the type of finish desired and the material type that composes the surface of the cylinder 20 being treated.

Furthermore, as already said, regulating if necessary through an electric control system, not represented in the drawing, the pressures in the pneumatic cylinders 37 represented in Fig. 5, is possible, through the suspension groups 32, to vary the pressure against the cylinder 20.

The number of brushes can obviously vary and in particular the number of brushes depends on the hardness of the material to be treated.

By way of illustration and for particular circumstances that require it, the number of brushes may be very numerous so producing on the cylinder 20 to be treated a pressure on practically all the length of its contact generator.

On the grounds of that described it is understood that the smoother-polisher of the invention achieves the established objects.

It is in fact noted that the smoothing-polishing machine of the invention, realizes cylindrical surfaces with a degree of superficial roughness comparable with those obtained with polishers of known type.

In fact using abrasive belts of increasingly fine grains it is possible to realize any degree of superficial finish, including polishing.

Furthermore it is also seen that given the constructive simplicity of the machine, it is also less expensive if compared to the known polisher types mentioned.

Experimental tests have consented furthermore to verify that smoothing and polishing times are remarkably reduced compared with orbital

smoothers and polishers of the known type, with percentage reductions that can even arrive at a quarter of the necessary time.

Furthermore, since the movement of the belt of the smoothing group is parallel to the generator of the cylinder being treated, all the eventual traces of indentation tracks produced on the surface of the cylinder from previous works of turning or of grinding are eliminated.

This thus allows to use the smoothing-polishing machine of the present invention for the treating of any type of cylinders and not only for the treating of rotogravure cylinders.

Furthermore this same smoother may also be used for treating flat surfaces. It is evident that in the realization phase the machine of the invention can undergo variations, that for example can consist of a different execution of the transportation mechanism and of advancement of the pressure rollers or even of a different suspension system of the same pressure group.

The said pressure group can for example be made movable in an horizontal direction sliding on the shafts 35 that form the suspension groups 32 so that on the surface 20 to be treated, acts an element of continuous pressure parallel to the rollers, instead of the rollers 7.

Such execution is particularly useful for the carrying out the polishing.

Furthermore, as far pressure rollers are concerned, which as already mentioned are composed from cylindrical brushes, these can also be made of different materials and of varying density so adapting them for the required finishes and for the type of material to be treated.

Finally as far as the pressure rollers are concerned, they can even be made with a curved profile so to increase the specific pressure at the contact point with the surface of the cylinder being treated.

It is evident however that all eventual variations mentioned are to be considered protected by the present invention.

Claims

1. Smoothing-polishing machine for cylindrical surfaces comprising a base (2) on which is a support and rotation group of the cylindrical surface (20) to be treated and at least one rising column (3) to which are connected:
   - a smoothing group (6) composed from an abrasive belt (50) wound between a pair of drums (21);
   - a pressure group (5) pressing the abrasive belt (50) against the cylindrical surface (20) to be treated,

   characterized by the fact that the said pressure group (5) is made from a case (14) that supports a plurality of idle cylindrical rollers (7), aligned amongst themselves and connected to a kinematic movement (62) of advancement able to move them in a direction parallel to the axis of the cylindrical surface (20) to be treated along its generator (57), where said cylindrical rollers (7), in the treatment phase, press on the backlining (60) of the abrasive belt (50), this last made horizontally movable according to the generator (57) of contact with the cylindrical surface (20) being treated by the rotation of the drums (21) in which it is wound.

2. Smoothing machine according to the claim 1 characterized by the fact that the rising column (3) is connected to the base (2) through at least one actuator (61) that makes it vertically movable in respect to the base (2) itself.

3. Smoothing machine according to the claim 1 characterized by the fact that the case (14) of the pressure group (5) is joined through a connection means to a support bracket (16) in its turn fixed to the movable element (17) of a first actuator (18) whose body is fixed to the rising column (3), and which to the said support bracket (16) is in its turn fixed the body of a second actuator (25) in which the movable element (24) supports a beam (23) to which electric motors (22) are fixed through brackets (77) each paired with one of the drums (21) in which the abrasive belt is wound (50) and that form the smoothing group (6).

4. Smoothing machine according to the claim 1 characterized by the fact that the support and rotation group of cylindrical surfaces (20) to be treated are made from a pair of mandrels (30) placed opposite each other and pressing on the base (2) of the smoother where at least one of said mandrels (30) is provided with a ratiomotor (31) for the rotation of the cylindrical surface (20) to be smoothed horizontally disposed and with the ends blocked between the mandrels (30) themselves.

5. Smoothing machine according to the claim 1 characterized by the fact that the idle cylindrical rollers (7) are cylindrical brushes wound in a felt sheath.

6. Smoothing machine according to the claim 1 characterized by the fact that the kinematic movement (62) of advancement of the idle cylindrical rollers (7) is made from a pair of toothed wheels (12) connected to the case (14) and made to rotate by a motor shaft (13), where each of the said toothed wheels (12)

engaging with a chain (10) to which is fixed one of the two ends of each pivot (8) of each idle cylindrical roller (7).

7. Smoothing machine according to the claim 1 characterized by the fact that between the rising column (3) and the base (2) is placed a pneumatic supporter constituted from a third actuator (27).

8. Smoothing machine according to the claim 1 characterized by the fact that on the base (2) is a tank (53) containing refrigerant liquid, placed below the cylinder (20) being treated, and in which a felt roller is present (52) placed parallel to the same cylindrical surface (20), which roller dips into refrigerant bath and is placed in contact with the same cylindrical surface (20) through the raising of a pair beams (51) fixed to the ends of the said felt cylinder (52).

9. Smoothing machine according to the claim 2 characterized by the fact that the actuator (61) that makes the rising column vertically movable (3) is a ratiomotor (4) fixed at the base (2) provided with a worm screw (67) paired to the column (3).

10. Smoothing machine according to the claim 3 characterized by the fact that the connection means that joins the case (14) of the pressure group (5) to the support bracket (16) are a crossbeam (15), fixed to the support bracket (16) itself, provided with a pair of suspension groups (32) each presenting a protruding shaft (35) that is paired in a throughole (36) made in the case (14) mentioned above.

11. Smoothing machine according to the claim 3 characterized by the fact that the body of the first actuator (18) is fixed to the rising column (3) in connection with the upper surface (19) of the same, the said surface being tilted with respect to the horizontal direction.

12. Smoothing machine according to the claim 3 characterized from the fact that the beam (23) is supported by a truss (28) provided by an elastic element composed from a spring (29).

13. Smoothing machine according to the claim 10 characterized by the fact that each protruding shaft (35) is fixed eccentrically to a bracket (33) in its turn coupled to the crossbar (15) through a rotation pivot (34).

14. Smoothing machine according to the claim 13 characterized by the fact that the bracket, (33) in connection with the underside in which the protrusive shaft is fixed (35), has a rotation actuator (37) fixed to the crossbar (15) and whose stem is connected to the protruding shaft (35) itself while in connection with the opposite end it has a reaction actuator (65) also fixed to the crossbar (15) and whose stem is fixed to the same bracket (33) .

15. Smoothing machine according to the claim 6 characterized by the fact that the ends of each pivot (8) are in a slidable guide (70) defined below the edge (71) of the case (14) and above a tubular protrusion (72) fixed to the case (14) on which is applied a strip (73) made of elastic material.

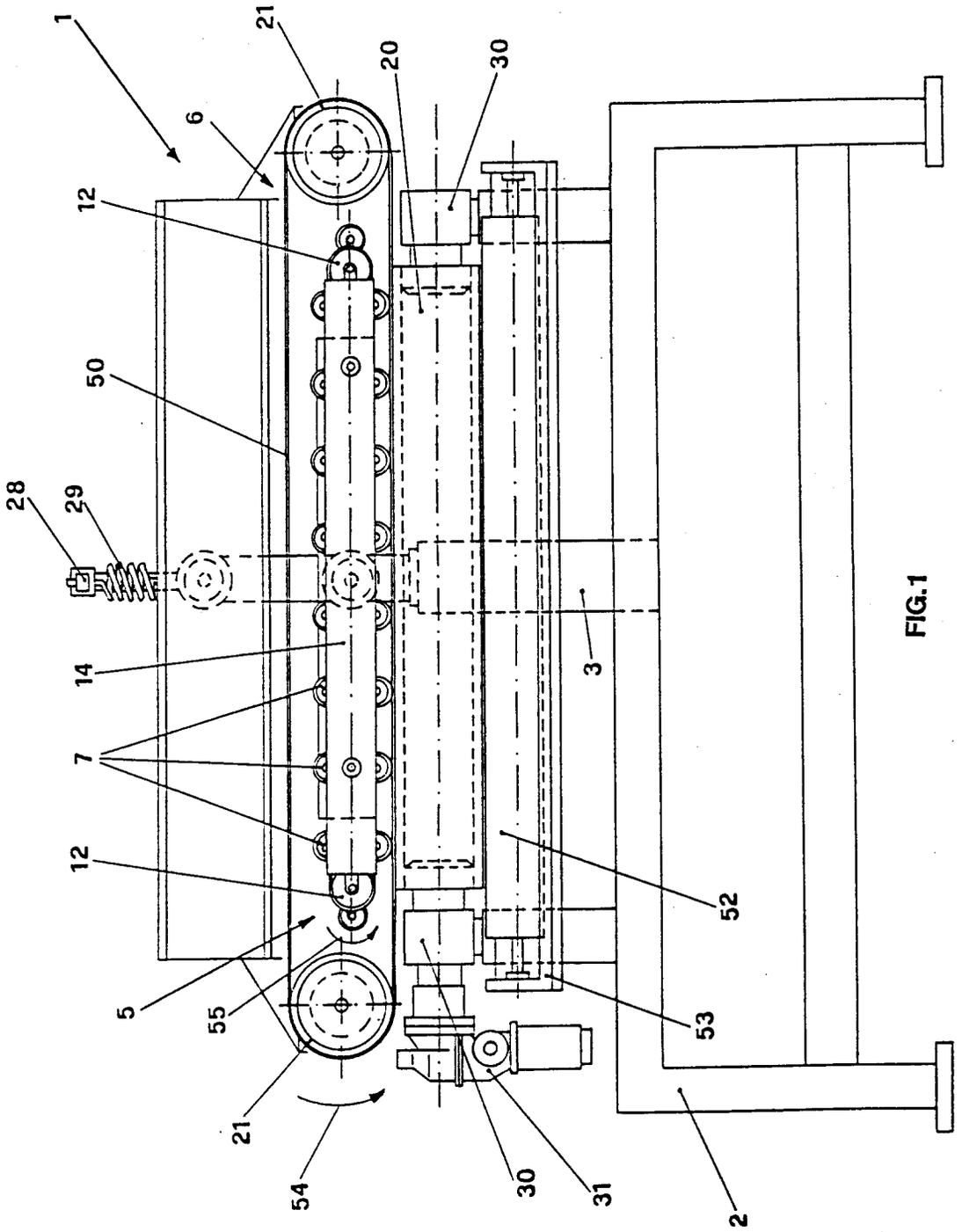

FIG.1

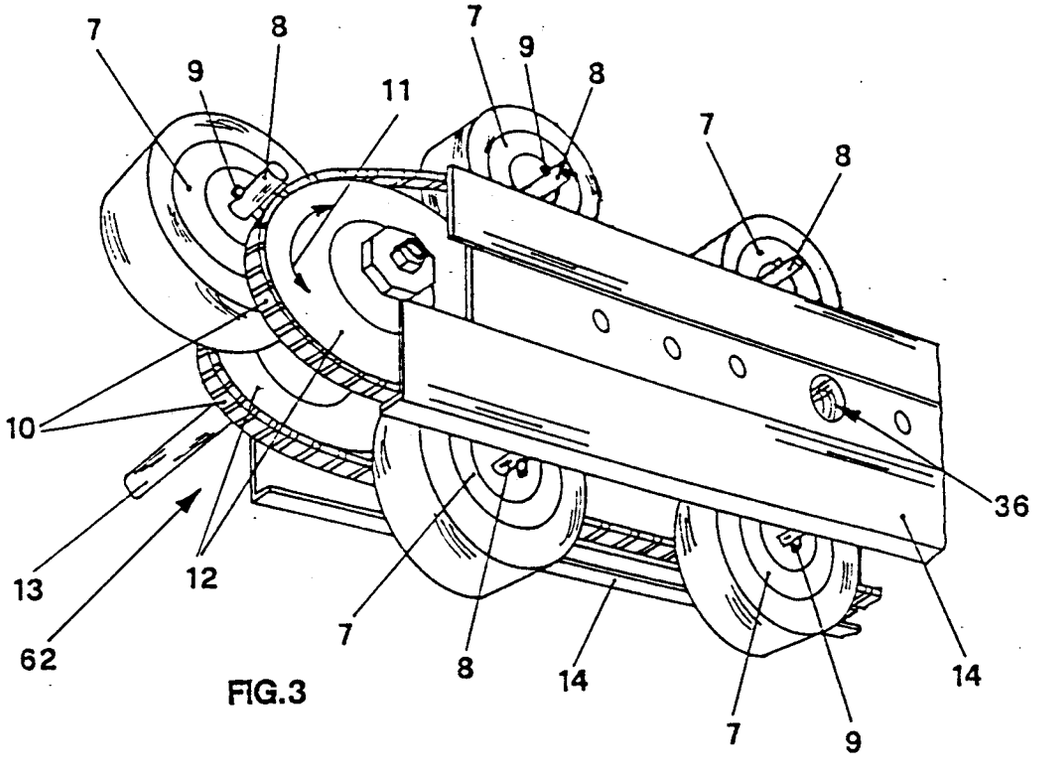
7
8
9
11
7
9
8
7
8
10
13
12
62
7
8
14
7
9
14
36

FIG.3

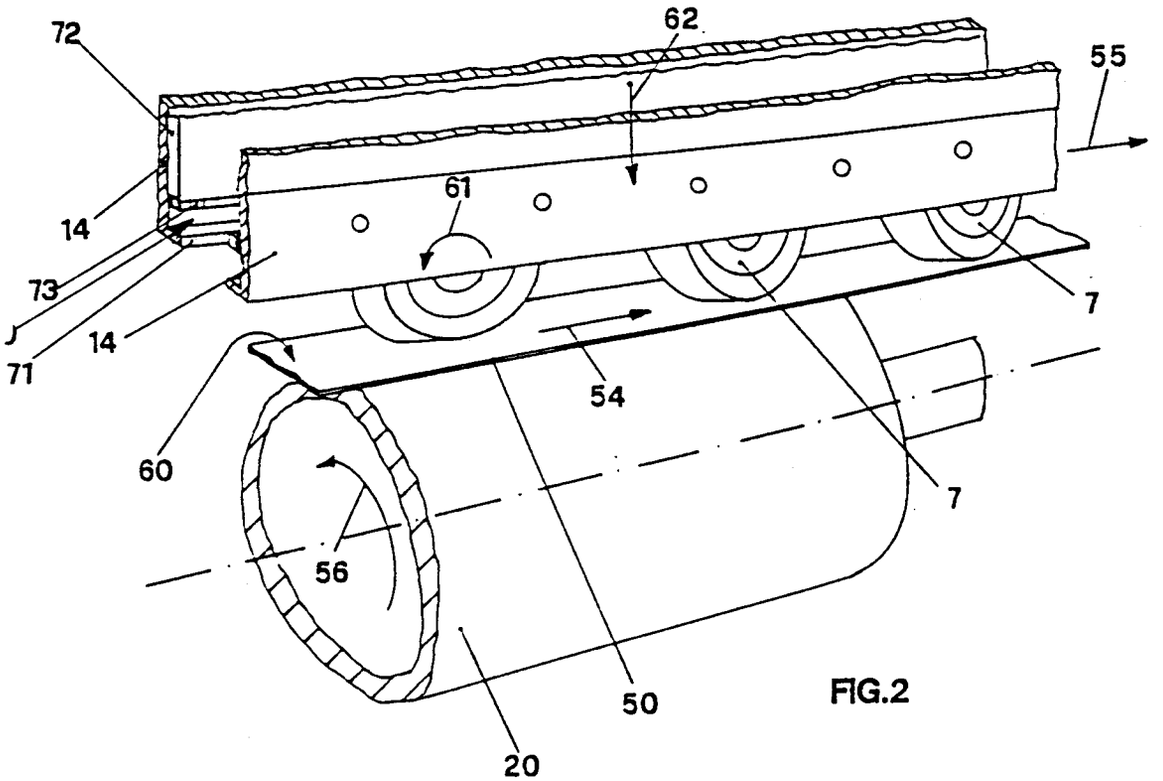
72
62
55
14
61
73
71
14
7
54
60
7
56
50
20

FIG.2

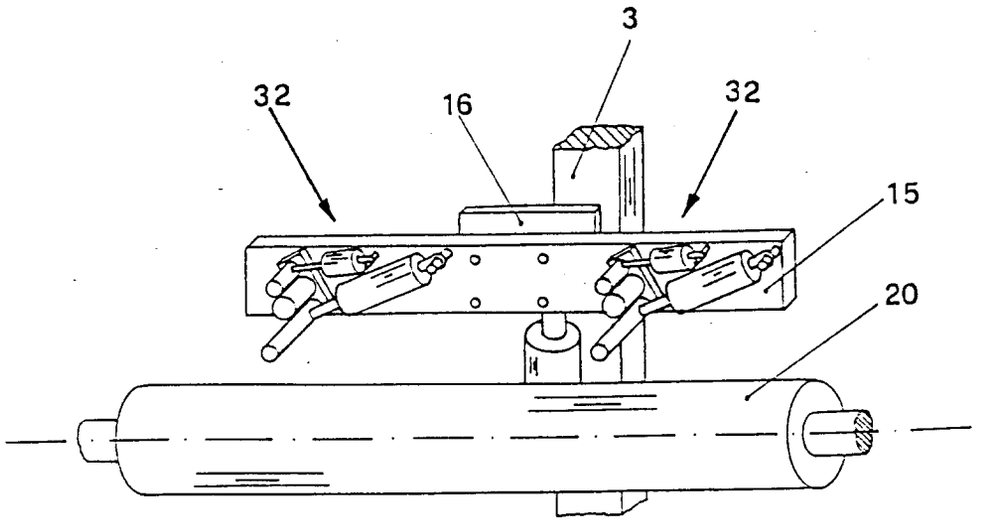

FIG.4

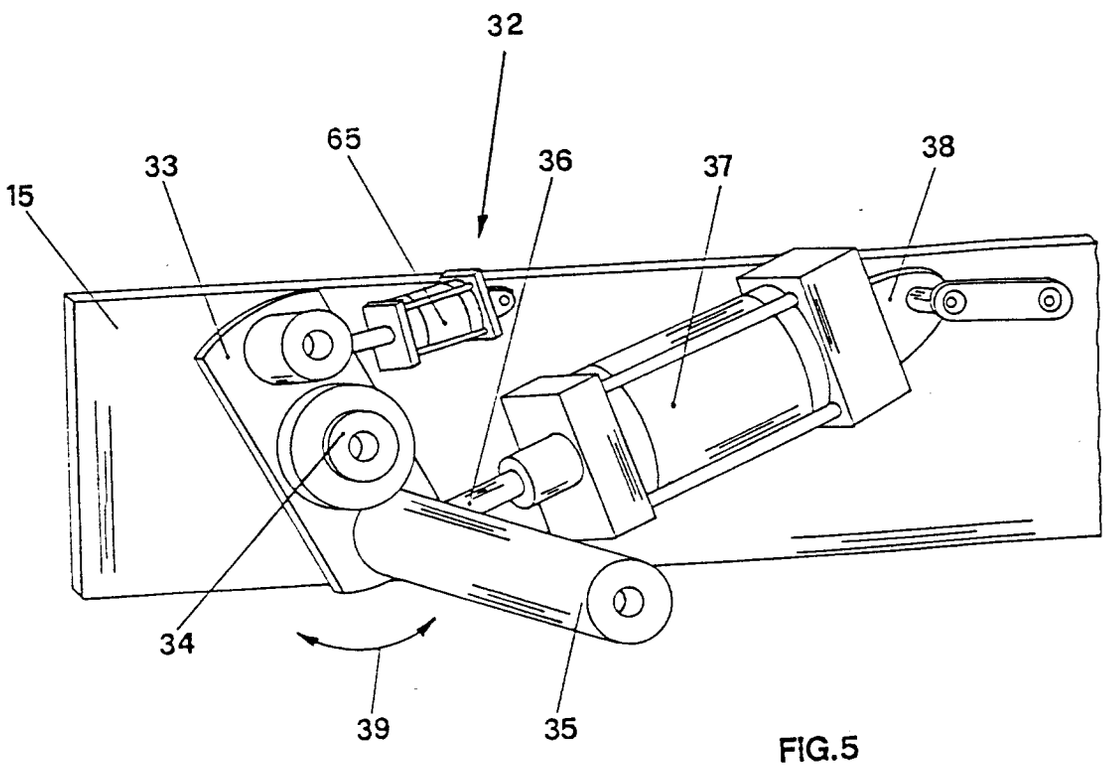

FIG.5

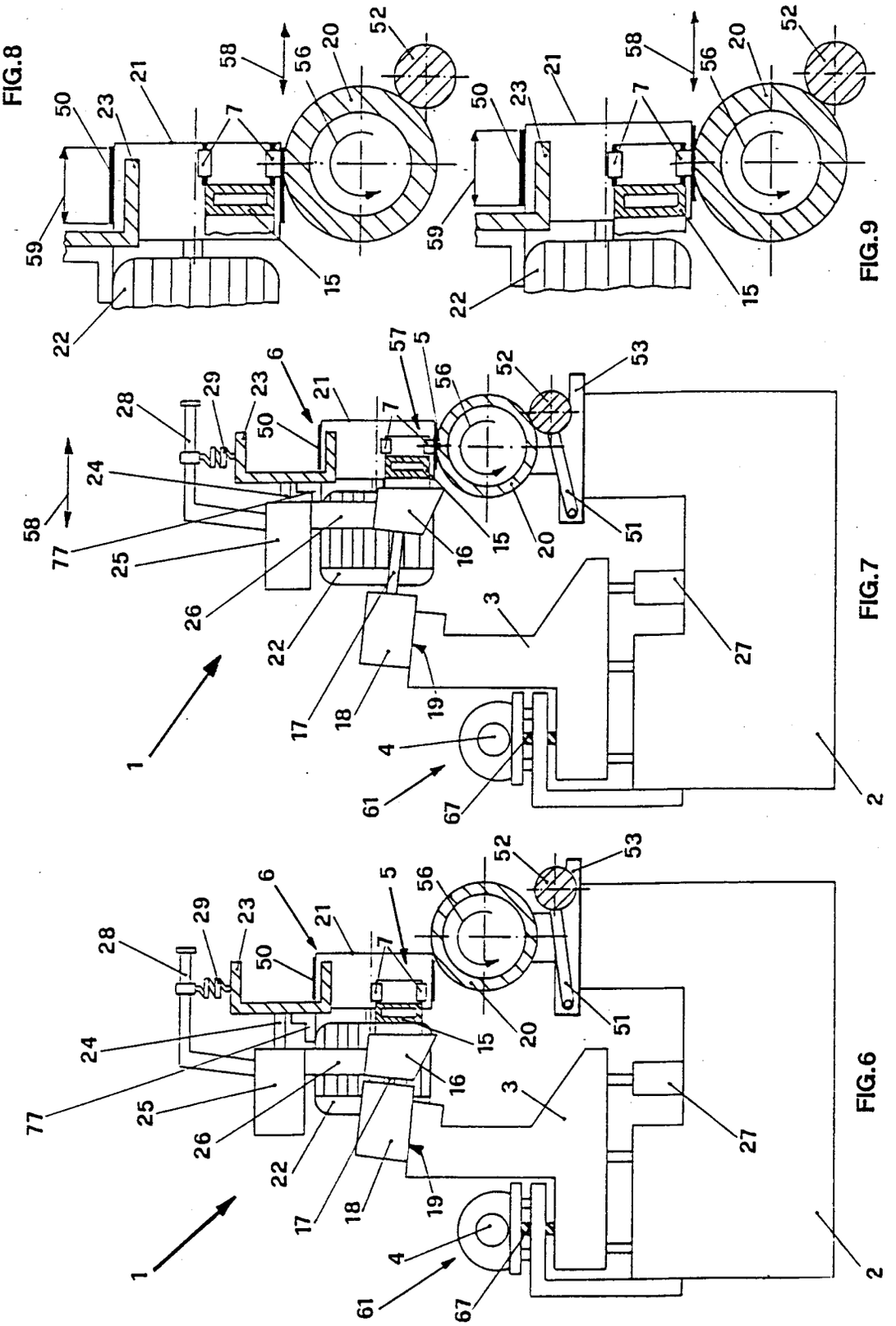
FIG.8
FIG.9
FIG.7
FIG.6
1
2
3
4
5
6
7
15
16
17
18
19
20
21
22
23
24
25
26
27
28
29
50
51
52
53
56
57
58
59
61
67
77

European Patent Office

EUROPEAN SEARCH REPORT

Application Number

EP 93 10 9274

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int. Cl.5)
X A	DE-C-1 072 504 (DR. KLAUS DAHMANN) * the whole document * ---	1,2 5,6	B24B21/02 B24B21/08 B24B21/14
A	FR-A-663 331 (PIERRE DEJOU ET AL.) * page 2, line 1 - line 79 * * page 3, line 78 - page 4, line 88; figures 1-3,5-7 * ---	1-6	
A	WO-A-8 601 447 (STAHL, HELMUT) * claims 1-12; figure 1 * ---	1,3-7	
A	HOLZ ALS ROH- UND WERKSTOFF vol. 47, no. 3, March 1989, BERLIN DE page 113 'Profilschleifmaschine mit oszillierendem Schleifband.' * page 113; figure 3 * ---	1-4,7,9	
A	DE-C-1 017 936 (MAX SCHERFF) * claims 1-4; figure 1 * ---	1-15	
A	DE-A-1 944 813 (NORTH AMERICAN ROCKWELL CORP.) * claims 1-7; figure 1 * -----	1	TECHNICAL FIELDS SEARCHED (Int. Cl.5) B24B

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
BERLIN	29 SEPTEMBER 1993	CUNY J.

CATEGORY OF CITED DOCUMENTS

X : particularly relevant if taken alone
Y : particularly relevant if combined with another document of the same category
A : technological background
O : non-written disclosure
P : intermediate document

T : theory or principle underlying the invention
E : earlier patent document, but published on, or after the filing date
D : document cited in the application
L : document cited for other reasons

& : member of the same patent family, corresponding document

EPO FORM 1503 03.82 (P0401)